CLAIMS as amended on 6 February 2006

1. A radar system for detection of one or more objects, said system comprising:

a radar wave transmitter for simultaneously transmitting a CW radar signal and a FM-CW radar signal,

first, second and third radar wave receivers for receiving CW and FM-CW radar signals reflected from one or more objects present in a detection range of the radar system,

first, second and third CW mixers for mixing CW transmission signals and reflected CW signals received by the first, second and third receiver, respectively, to produce one or more corresponding first, second and third CW beat signals, each first, second and third CW beat signal relating to the velocity of an object, and

first, second and third FM-CW mixers for mixing FM-CW transmission signals and reflected FM-CW signals received by the first, second and third receivers, respectively, to produce one or more corresponding first, second and third FM-CW beat signals, each first FM-CW beat signal relating to the distance to and the velocity of an object, wherein

at least two receivers are arranged along a first receiver direction and at least two receivers are arranged along a second receiver direction, said first receiver direction being different to the second receiver direction.

2. A radar system according to 1, further comprising means for detecting phase differences between corresponding reflected CW or FM-CW radar signals received by at least two different radar wave receivers.

3. A radar system according to claim 2, wherein the phase detecting means are adapted to determine a first phase difference between corresponding reflected CW or FM-CW radar signals received by said at least two radar wave receivers arranged along the first receiver direction, and to determine a second phase difference between corresponding reflected CW or FM-CW radar signals received by said at least

two radar wave receivers arranged along the second receiver direction, said first phase difference relating to a first object angular direction, and said second phase difference relating to a second object angular direction.

4. A radar system according to claim 3, wherein the phase detecting means are adapted to determine the first phase difference from at least two Fourier transformed outputs representing CW or FM-CW signals corresponding to the at least two receivers arranged along the first receiver direction, and to determine the second phase difference from at least two Fourier transformed outputs representing CW or FM-CW signals corresponding to the at least two receivers arranged along the second receiver direction.

5. A radar system according to any one of the claims 1-4, wherein for each CW mixer there is corresponding transforming means for taking the Fourier transform of the beat signal(s) from said CW mixer.

6. A radar system according to claim 5, further comprising means for summing the Fourier transformed outputs corresponding to each of said CW mixer and for determining a number of CW peak frequencies from the summed Fourier transformed CW signals.

7. A radar system according to any one of the claims 1-5, wherein for each FM-CW mixer there is corresponding transforming means for taking the Fourier transform of the beat signal(s) from said FM-CW mixer.

8. A system according to claim 7, further comprising means for summing the Fourier transformed outputs corresponding to each of said FM-CW mixer and for determining a number of FM-CW peak frequencies from the summed Fourier transformed FM-CW signals.

9. A radar system for detection of one or more objects, said system comprising:

a radar wave transmitter for simultaneously transmitting a CW radar signal and a FM-CW radar signal,

first, second and third radar wave receivers for receiving CW and FM-CW radar signals reflected from one or more objects present in a detection range of the radar system,

first, second and third CW mixers for mixing CW transmission signals and reflected CW signals received by the first, second and third receiver, respectively, to produce one or more corresponding first, second and third CW beat signals, each first, second and third CW beat signal relating to the velocity of an object, and

first, second and third FM-CW mixers for mixing FM-CW transmission signals and reflected FM-CW signals received by the first, second and third receivers, respectively, to produce one or more corresponding first, second and third FM-CW beat signals, each first FM-CW beat signal relating to the distance to and the velocity of an object, wherein

for each CW mixer there is corresponding transforming means for taking the Fourier transform of the beat signal(s) from said CW mixer, and the radar system further comprises means for summing the Fourier transformed outputs corresponding to each of said CW mixer and for determining a number of CW peak frequencies from the summed Fourier transformed CW signals, and/or wherein

for each FM-CW mixer there is corresponding transforming means for taking the Fourier transform of the beat signal(s) from said FM-CW mixer, and the radar system further comprises means for summing the Fourier transformed outputs corresponding to each of said FM-CW mixer and for determining a number of FM-CW peak frequencies from the summed Fourier transformed FM-CW signals.

10. A radar system according to any one of the claims 1-9, further comprising:

a fourth radar wave receiver for receiving reflected CW and FM-CW or MF radar signals,

a fourth CW mixer for mixing CW transmission signals and reflected CW signals received by the fourth receiver to produce one or more fourth CW beat signals, each fourth CW beat signal relating to the velocity of an object, and

a fourth FM-CW mixer for mixing FM-CW transmission signals and reflected FM-CW signals received by the fourth receiver to produce one or more fourth FM-

CW beat signals, each fourth FM-CW beat signal relating to the distance to and the velocity of an object, wherein

for the fourth CW mixer there is corresponding transforming means for taking the Fourier transform of the beat signal(s) from said fourth CW mixer, and for the fourth FM-CW mixer there is corresponding transforming means for taking the Fourier transform of the beat signal(s) from said fourth FM-CW mixer,

said radar system further comprising means for summing the Fourier transformed outputs corresponding to the fourth CW mixer and for determining a number of CW peak frequencies from these summed Fourier transformed CW signals, and means for summing the Fourier transformed outputs corresponding to the fourth FM-CW mixer and for determining a number of FM-CW peak frequencies from these summed Fourier transformed FM-CW signals.

11. A radar system according to any one of the claims 1-10, wherein at least two receivers are arranged along a first receiver direction and at least two receivers are arranged along a second receiver direction, said first receiver direction being different to the second receiver direction.

12. A radar system according to claim 1 or 11, wherein the first and second receiver directions are substantially perpendicular to each other.

13. A radar system for detection of one or more objects, said system comprising:

a radar wave transmitter for simultaneously transmitting a CW radar signal and a FM-CW radar signal,

first, second and third radar wave receivers for receiving CW and FM-CW radar signals reflected from one or more objects present in a detection range of the radar system,

first, second and third CW mixers for mixing CW transmission signals and reflected CW signals received by the first, second and third receiver, respectively, to produce one or more corresponding first, second and third CW beat signals, each first, second and third CW beat signal relating to the velocity of an object, and

first, second and third FM-CW mixers for mixing FM-CW transmission signals and reflected FM-CW signals received by the first, second and third receivers, respectively, to produce one or more corresponding first, second and third FM-CW

beat signals, each first FM-CW beat signal relating to the distance to and the velocity of an object, wherein

for each CW mixer there is corresponding transforming means for taking the Fourier transform of the beat signal(s) from said CW mixer, and for each FM-CW mixer there is corresponding transforming means for taking the Fourier transform of the beat signal(s) from said FM-CW mixer, and

wherein at least two receivers are arranged along a first receiver direction and at least two receivers are arranged along a second receiver direction, said first receiver direction being different to the second receiver direction,

said radar system further comprising phase detecting means for detecting phase differences between corresponding reflected CW or FM-CW radar signals, wherein

the phase detecting means are adapted to determine a first phase difference between corresponding reflected CW or FM-CW radar signals received by said at least two radar wave receivers arranged along the first receiver direction, said first phase difference relating to a first object angular direction, and

the phase detecting means are adapted to determine a second phase difference between corresponding reflected CW or FM-CW radar signals received by said at least two radar wave receivers arranged along the second receiver direction, said second phase difference relating to a second object angular direction,

said radar system further comprising means for establishing and maintaining one or more CW track records corresponding to one or more objects, each track record comprising a number of detected CW peak frequencies as a function of time and further holding information of first and second angular directions as a function of time determined from measurements of corresponding first and second phase differences, and/or

said radar system further comprising means for establishing and maintaining one or more FM-CW track records corresponding to one or more objects, each track record comprising a number of detected FM-CW peak frequencies as a function of time and further holding information of first and second angular directions as a function of time determined from measurements of corresponding first and second phase differences.

14. A radar system according to claim 13, further comprising:

a fourth radar wave receiver for receiving reflected CW and FM-CW or MF radar signals,

a fourth CW mixer for mixing CW transmission signals and reflected CW signals received by the fourth receiver to produce one or more fourth CW beat signals, each fourth CW beat signal relating to the velocity of an object, and

a fourth FM-CW mixer for mixing FM-CW transmission signals and reflected FM-CW signals received by the fourth receiver to produce one or more fourth FM-CW beat signals, each fourth FM-CW beat signal relating to the distance to and the velocity of an object, wherein

for the fourth CW mixer there is corresponding transforming means for taking the Fourier transform of the beat signal(s) from said fourth CW mixer, and for the fourth FM-CW mixer there is corresponding transforming means for taking the Fourier transform of the beat signal(s) from said fourth FM-CW mixer.

15. A radar system according to claim 13 or 14, further comprising means for summing the Fourier transformed outputs corresponding to each of said CW mixer and for determining a number of CW peak frequencies from the summed Fourier transformed CW signals.

16. A radar system according to any one of the claims 13-15, further comprising means for summing the Fourier transformed outputs corresponding to each of said FM-CW mixer and for determining a number of FM-CW peak frequencies from the summed Fourier transformed FM-CW signals.

17. A radar system according to any one of the claims 13-16, wherein the phase detecting means are adapted to determine the first phase difference from at least two Fourier transformed outputs representing CW or FM-CW signals corresponding to the at least two receivers arranged along the first receiver direction, and wherein the phase detecting means are adapted to determine the second phase difference from at least two Fourier transformed outputs representing CW or FM-CW signals corresponding to the at least two receivers arranged along the second receiver direction.

18. A radar system according to any one of the claims 13-17, wherein the first and second receiver directions are substantially perpendicular to each other.

19. A radar system according to any one of the claims 13-18, wherein at least two receivers are arranged horizontally besides each other, whereby a detected time or phase difference between corresponding radar signals received by the two horizontally arranged receivers relates to an azimuth phase difference.

20. A radar system according to any one of the claims 13-19, wherein at least two receivers are arranged vertically above each other, whereby a detected time or phase difference between corresponding radar signals received by the two vertically arranged receivers relates to an elevation phase difference.

21. A radar system according to any one of the claims 13-20, wherein the phase detecting means are adapted to determine first and second phase differences for Fourier transformed outputs corresponding to a selected CW peak frequency, and for Fourier transformed outputs corresponding to a selected FM-CW peak frequency.

22. A radar system for detection of one or more objects, said system comprising:

a radar wave transmitter for simultaneously transmitting a CW radar signal and a FM-CW radar signal,

first, second, third and fourth radar wave receivers for receiving CW and FM-CW radar signals reflected from one or more objects present in a detection range of the radar system,

first, second, third and fourth CW mixers for mixing CW transmission signals and reflected CW signals received by the first, second, third and fourth receivers, respectively, to produce one or more corresponding first, second, third and fourth CW beat signals, each first, second, third and fourth CW beat signal relating to the velocity of an object, and

first, second, third and fourth FM-CW mixers for mixing FM-CW transmission signals and reflected FM-CW signals received by the first, second, third and fourth receivers, respectively, to produce one or more corresponding first, second, third and fourth FM-CW beat signals, each first FM-CW beat signal relating to the distance to and the velocity of an object, wherein

the first and second receivers are arranged horizontally besides each other, the third and fourth receivers are arranged horizontally besides each other, with the

third and fourth receivers being arranged vertically below the first and second receivers, respectively, and wherein

for each CW mixer there is corresponding transforming means for taking the Fourier transform of the beat signal(s) from said CW mixer, and

for each FM-CW mixer there is corresponding transforming means for taking the Fourier transform of the beat signal(s) from said FM-CW mixer,

said radar system further comprising phase detecting means for detecting phase differences between corresponding reflected CW or FM-CW radar signals,

wherein the phase detecting means are adapted to determine an azimuth phase difference between the sum of the two Fourier transformed outputs corresponding to the first and third receivers and the sum of the two Fourier transformed outputs corresponding to the second and fourth receivers, and/or

wherein the phase detecting means are adapted to determine an elevation phase difference between the sum of the two Fourier transformed outputs corresponding to the first and second receivers and the sum of the two Fourier transformed outputs corresponding to the third and fourth receivers.

23. A radar system according to claim 22, further comprising means for summing the Fourier transformed outputs corresponding to each of said CW mixer and for determining a number of CW peak frequencies from the summed Fourier transformed CW signals, and further comprising means for summing the Fourier transformed outputs corresponding to each of said FM-CW mixer and for determining a number of FM-CW peak frequencies from the summed Fourier transformed FM-CW signals.

24. A radar system according to any one of the claims 1-23, wherein the radar wave transmitter is adapted for simultaneously transmitting a CW radar signal and a FM-CW radar signal, wherein the FM-CW radar signal is a ramp modulated signal.

25. A radar system according to claim 24, wherein the ramp modulated signal has an up-ramp waveform with an increase in frequency during the up-ramp period or a down-ramp waveform with a decrease in frequency during the down ramp period.

26. A radar system according to any one of the claims 1-23, wherein

the radar wave transmitter is adapted for simultaneously transmitting a CW radar signal and a FM-CW radar signal, wherein the FM-CW radar signal has a triangular shaped waveform with up-ramp periods having an increase in frequency and down-ramp periods having a decrease in frequency.

27. A radar system according to any one of the claims 1-26, further comprising means for determining an object velocity or an relative object velocity of one or more objects based on at least part of the produced CW beat signals.

28. A radar system according to any one of the claims 6-27, further comprising means for determining a CW object velocity based on a selected CW peak frequency, said CW object velocity corresponding to the velocity or the relative velocity of an object providing a Doppler frequency corresponding to the selected CW peak frequency.

29. A radar system according to any one of the claims 8-28, wherein the radar wave transmitter is adapted for transmitting a FM-CW radar signal having a triangular waveform with the frequency being increased at a given first rate and decreased at said first rate, and wherein the radar system comprises:

means for selecting from the determined FM-CW peak frequencies a pair of FM-CW peak frequencies corresponding to consecutive up- and down ramps of the transmitted FM-CW signal,

means for determining a FM-CW object velocity based on the selected pair of FM-CW peak frequencies,

means for comparing the determined FM-CW object velocity with one or more determined CW object velocities to thereby obtain a CW peak frequency corresponding to the selected pair of FM-CW peak frequencies, and

means for determining an object distance from the selected pair of FM-CW peak frequencies or from the corresponding CW peak frequency and at least one of the selected pair of FM-CW peak frequencies.

30. A radar system according to any one of the claims 13-21, further comprising means for, based on a selected track record holding CW peak frequency information and information of first and second angular directions as a function of time, predicting for an object corresponding to said selected track record expected CW peak

frequencies and first and second angular information at a required time posterior to the time of the last stored peak frequency information of said selected track record.

31. A radar system according to any one of the claims 13-21, further comprising means for, based on a selected track record holding FM-CW peak frequency information and information of first and second angular directions as a function of time, predicting for an object corresponding to said selected track record expected FM-CW peak frequencies and first and second angular information at a required time posterior to the time of the last stored peak frequency information of said selected track record.

32. A radar system according to any one of the claims 13-21, further comprising means for selecting from the CW track records and the FM-CW track records one or more pairs of CW and FM-CW peak frequencies having corresponding first and second angular directions or corresponding azimuth and elevation angles, and for determining from an obtained pair of CW and FM-CW peak frequencies an object velocity and a corresponding object distance.

33. A radar system according to claim 29 or 32, further comprising means for establishing and maintaining one or more track records holding combined CW and FM-CW peak frequency information as a function of time for one or more objects having a velocity and distance determined from a pair of previously measured CW and/or FM-CW peak frequencies having corresponding velocities.

34. A radar system according to claim 33, further comprising means for, based on a selected track record holding combined CW and FM-CW peak frequency information as a function of time, predicting for an object corresponding to said selected track record expected CW and FM-CW peak frequencies at a required time posterior to the time of the last stored peak frequency information of said selected track record.

35. A radar system according to claim 32, further comprising means for establishing and maintaining one or more track records holding combined CW and FM-CW peak frequency information and information of first and second angular directions as a function of time for one or more objects having a velocity and distance determined

from a pair of previously measured CW and FM-CW peak frequencies having corresponding first and second angular directions.

36. A radar system according to claim 35, further comprising means for, based on a selected track record holding combined CW and FM-CW peak frequency information and information of first and second angular directions as a function of time, predicting for an object corresponding to said selected track record expected CW and FM-CW peak frequencies and information of first and second angular directions at a required time posterior to the time of the last stored peak frequency information of said selected track record.